

24 MAR 1994

MEETING LOG
DIRECTORATE FOR ENGINEERING SCIENCES

SUBJECT: Ad Hoc Committee for the Effects of Tight Building Construction on Heating Appliances

PLACE: Underwriters Laboratories, Northbrook, IL

MEETING DATE: 2-17-94

LOG ENTRY SOURCE: Donald W. Switzer *Das 9)*

ENTRY DATE: 3-21-94

COMMISSION ATTENDEES:

Donald W. Switzer

ES

NON-COMMISSION ATTENDEES:

See attached minutes

MEETING SUMMARY:

There have been numerous anecdotal reports of tight home construction affecting safe operation of home heating appliances. Underwriters Laboratories (UL) called a meeting of interested parties to consider issues related to the use of combustion equipment in tight building construction. The minutes of the meeting are attached and accurately reflect the discussions at the meeting. Staff plans to review the possible solutions outlined in the minutes and comment to UL as appropriate.

CPSA 6 (b)(7) Cleared
3/30/94
No Mfrs/PrvtLbrs or
Products Identified
by
[Signature]
[Signature]



Subjects 127 (1482)

12 Laboratory Drive
Research Triangle Park, NC 27709
March 11, 1994

TO: Ad Hoc Committee of UL for the Effects of Tight Building
Construction on Combustion Appliances

Carl Adams	Peter Hanly	Gary Nelson
Irwin Billick	Bob Hemphill	Randy Nelson
Robert Borgesson	Pat Huelman	James Norman
Larry Brand	Mark Jackson	Mike O'Rourke
Robert Brown	David Johnston	Stan Pople
Al Callahan	Jack Langmead	Dale Rammien
John Crouch	Ted Lemoff	James Ranfone
Dennis Dietz	Neil Leslie	Gary Satterfield
Tom Frost	Michael Lubliner	Bill Schmidt
Dave Godewin	Mike McCase	Ron Shimek
John Gulland	Kevin McKinley	Paul Stegmeir
David Grimsrud	Rick Mendlin	Donald Switzer
Terry Hammond	Richard Morris	

SUBJECT: Report of Meeting of the Ad Hoc Committee of UL for the
Effects of Tight Building Construction on Combustion
Appliances

SUMMARY OF TOPICS

The following items were discussed at the meeting:

1. Purpose of Meeting
2. Introduction
3. Tight Building Discussions
4. Summary

COMMENTS DUE BY: APRIL 15, 1994

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A meeting of the Ad Hoc Committee of UL for the Effects of Tight Building Construction on Combustion Appliances was held on February 17, 1994 at the UL Northbrook Office. The purpose of the meeting was to discuss the effects of tight building construction on combustion equipment.

Attached as Appendix A is a matrix of requirements identified as being specified in various codes.

Attached as Appendix B is a chart on brainstormed issues and opportunities.

Attached as Appendix C is a list of those who attended the meeting.

The following report is not intended to be a verbatim transcript of the discussions at the meeting, but is intended to record the significant features of those discussions.

1. PURPOSE OF MEETING

There have been field reports concerning the effects on combustion appliances from building constructions that have not adequately taken into account complete building air exchanges. These may relate to backdrafting of vented appliances, incomplete combustion in heating appliances, and concerns about indoor air quality. Based on this information, UL determined that an ad hoc committee could be formed to discuss the concerns related to combustion equipment and air exhausting equipment that are currently covered by various UL Standards.

2. INTRODUCTION

UL presented a matrix of requirements identified as being specified in various codes including building codes. The matrix is attached as Appendix A. The only requirement identified as being consistent among all codes is a requirement that indicates sufficient air for combustion should be considered. Two requirements not included in any of the codes are:

- a) A requirement to consider make-up air for other exhaust systems that are included in the construction of the home, such as exhaust fans, dryers, etc. (A related requirement does appear in the Standard Mechanical Code), and
- b) A requirement to consider the need for appliances that can operate properly in an interior ambient air pressure that is not equal to the outdoor air pressure.

UL led the ad hoc committee in a discussion on possible solutions that could be developed. The following tabulation lists those identified as possible ways to address air flow in houses:

- Revise codes to be more prescriptive on how to satisfy the intent and how to determine that key expectations have been met.
- Provide more training for builders or appropriate subcontractors to identify the optional methods (including restrictions) on equalizing combustion appliance ambient air pressure to outdoor air pressure and providing "make-up" air for other air exhausting products.

- Revise heating appliance designs to make them less susceptible to backdrafting when operated in an ambient air pressure not equal to outdoor air pressure.
- Revise appliance test standards to specify additional testing to demonstrate suitable operation in an ambient air pressure not equal to outdoor pressure.
- Standardize simple on-site measurement techniques to cost effectively understand the effects on combustion appliances on indoor ambient air pressure with respect to outdoor air pressure including evaluations of other air exhausting products.
- Reconsider the balance between well insulated home construction and the need to provide air exchanges within a house and/or provide suitable information on how to balance energy concerns with the need for quality indoor air.

3. TIGHT BUILDING DISCUSSIONS

The following presentations were provided by several ad hoc committee members:

- a) Building code coverage for air for combustion,
- b) Update on gas industry research, and
- c) Solid fuel industry perspectives.

After these presentations, it was clear that there is not a consensus at this time on any single action that could be taken to address the building pressures issue. In order to seek consensus on a direction, the ad hoc committee decided to brainstorm issues and opportunities, and how they relate in the real world or theoretical situation. Appendix B indicates these results.

The ad hoc committee then discussed various solutions considering both long term and short term possibilities. Possible solutions are as follows:

- Further study of the issues in a comprehensive manner was suggested with the comment that often the biggest cause of problems is a solution.
- Provide further information to consumers, installers, and builders to make them aware of the effects of improper installation. This should address both new constructions and remodelling of old constructions.
- Provide house designers with information on a product's effect on house pressures and information on how to properly mitigate the effect.

- Create devices to monitor specific house conditions and provide suitable ventilation (and/or alarms) in response to adverse conditions.
- Develop testing standards and procedures to be used in the field to measure pressure differentials under specific conditions.
- Revise building codes to specifically address the requirements for pressure equalization in a house.
- Expand codes to address and relate:
 - Air for combustion, air for ventilation, air for venting
 - Make-up air for stack effect
 - Make-up air for mechanical exhaust
 - Ventilation for human needs
- Optional marked rating (degree of exposure to a pressure imbalance) of a combustion appliance to operate properly when tested in an environment with a pressure differential.
- It was suggested that if each different involved person or organization worked to assist in an overall effort, better results would be obtained.
- Develop product standards for high volume exhaust products to identify the need for "make-up" air, require the products to provide "make-up" air and/or provide information on the subject.

4. SUMMARY

UL would like comments on the possible need for UL to propose an optional test and rating for solid fuel and/or oil fired appliances for use in ambient air pressures not equal to outdoor air pressures and/or any other specific actions that can be taken by UL to assist with the overall effort to provide suitable indoor air at a reasonable energy efficiency and avoid the adverse effects of backdrafting, incomplete combustion, and providing suitable building air. At this time, UL plans to review all comments on this issue before further action is taken.

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UL thanks the representatives for their attendance at the meeting and for the valuable input we received.

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Request for Comments on Proposals

Please provide your comments concerning the meeting report.

Comments should be sent to the attention of Keri Olson at the Research Triangle Park office of UL, 12 Laboratory Drive, Research Triangle Park, NC 27709.

All comments should be sent by April 15, 1994. Unless specifically requested to do otherwise, UL will not acknowledge comments indicating concurrence with these proposals.

UNDERWRITERS LABORATORIES INC.

REVIEWED BY:

Keri L. Olson

H.T. Jones / HJO

KERI OLSON (Ext. 1460)
Associate Project Engineer
Standards Department
Research Triangle Park Office

HARRY JONES (Ext. 42948)
Associate Managing Engineer
Engineering Services
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Managing Engineer
Engineering Services
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SR:SAB

APPENDIX A**AIR FOR COMBUSTION ISSUES IN VARIOUS CODES**

General Requirement	ASHRAE 62	Z223.1	NFPA 211	Standard Mechanical Code	BOCA	UMC
- Sufficient Air for Combustion	X	X	X	X	X	X
- Field test to verify sufficient air for combustion	X	X				
- Exempts direct vent equipment from air for combustion requirements		X		X	X	X
- Requires outside air when there is insufficient inside air		X				
- Specifies minimum air opening size to supply air for combustion		X		X	X	X
- Mechanical booster systems shall be interlocked to burner control			X		X	
Specifies <u>larger</u> minimum air opening size to supply air for combustion in tight buildings				X		
- Prohibit exhaust fans that exhaust air at greater rates than can be "made-up" by planned on incidental air inflow				X		
- Requires outside air for equipment in tight buildings					X	X
- Specifies that all air exhaust systems shall be considered in the installation when determining the "make-up" air required to maintain a pressure balance						X
- Requires that appliances be capable of proper operation in a specific adverse pressure environment						
- States exactly how to determine the "make-up" air required for <u>all</u> air exhausting sources						

A P P E N D I X B
ISSUES AND OPPORTUNITIES

REAL WORLD
Tight houses will increase/will exist
Existing houses will get tighter
Exhaust capacity is increased New retrofit
Kitchen exhaust big contributor
Must heat make up air
Energy efficiency is a factor and will become more important
Building codes do not cover all of these issues
Imbalances of forced air distribution systems can cause pressure imbalances
We don't know how to measure pressure differential, what is acceptable, and where to measure it
Air Leakage/Infiltration models do not predict air leakage/infiltration regulations
Need to consider typical operation of appliances
Natural ventilation will not work - will be lost due to improvements
No formula for mechanical vents or a way to calculate suitable "make-up" air
Mechanical ventilation may not work due to mis-installing, improper design, local conditions
Cost and comfort drives consumer choices
Manufacturers and builders have increased complaints when backdrafting occurs
Improper installation is a big factor
Improper design can contribute to backdrafting
Multi-family homes may pose more variables

THEORY
Low level air exhaust products not a big factor - time and volume
High level air exhaust doesn't have a make up air requirement
Atmospheric combustion products contribute
Increase in adverse health effects
Other health effects as a result of: - radon - human occupation
Combustion Products
Building codes provide rational guidance
We know how to measure
Worst case can be developed but may not adequately address real world situations
Natural ventilation can work but in the real world installation is the key
Mechanical ventilation does work if installed correctly
There are many variables, no simple answers
Nothing works perfectly

Note: Theory items were identified to indicate that further research and/or study is required to establish a suitable knowledge base in order to present an acceptable solution.

A P P E N D I X C

**ATTENDANCE AT THE FEBRUARY 17, 1994 MEETING
OF THE AD HOC COMMITTEE FOR THE EFFECTS OF
TIGHT BUILDING CONSTRUCTION ON COMBUSTION APPLIANCES**

Industry Representatives

Irwin Billick	Gas Research Institute
Larry Brand	Gas Research Institute
Al Callahan	International Approval Services
Dennis Dietz	American Aldes Ventilation Company
Bob Hemphill	Gas Research Institute
David Johnston	NFPA-DSJ
Jack Langmead	GAMA
Theodore Lemoff	NFPA
Neil Leslie	Gas Research Institute
Richard Morris	NAHB
Gary Nelson	Energy Conservatory
Randy Nelson	City of Colorado Springs Gas Dept.
Stan Pople	UL Canada
Dale Rammien	HVI
James Ranfone	Amercian Gas Association
Gary Satterfield	HPA
Ron Shimek	Heat-N-Glow Fireplace Products
Paul Stegmeir	NC HPA
Donald Switzer	U.S. CPSC

UL Staff

Don Grob - Chairman
Harry Jones

Keri Olson
Bob Zimmerman